Renewable Energy & Critical Minerals Superpower

Altius Sustainability Advisory Committee

24 August 2023
The challenge facing Australian industry policy in light of the US IRA

1. The Global Energy Transition

2. Energy Transition: China leads the world; and this is a global technology and investment race

3. The US IRA Changes Everything – A race to the top
   • South Korea re batteries

4. The Australia-US Compact: Climate change, critical minerals and clean energy is the third pillar of the Australia-US alliance; Australia’s Critical Minerals Strategy; Australian Exports – Embodied Decarbonisation

5. Stock market examples of Energy Transition

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Australia needs another $100bn of public strategic capital to crowd-in $200-300bn of private capital

Tim Buckley, Climate Energy Finance, Sydney – Please note this is public interest research, CEF does not provide general or specific financial advice.
The move to zero emissions renewable energy is deflationary, in absolute terms, and recently relative to hyperinflation of fossil fuel commodities.

1. The Global Energy Transition

The Cost of Renewable Energy Has Plummeted

Cost of building and running new power plants, in dollars per megawatt hour

Source: Lazard, via NY Times
1. The Global Energy Transition

Emissions must fall to zero by mid-century to meet global target
1. The Global Energy Transition

There is nothing slow, orderly or ambiguous about global momentum in the energy transition.

Annual capacity additions for solar PV and wind and electric car sales

Source: IEA Critical Minerals Market Review July 2023
1. The Global Energy Transition

Global Investment Needed to reach Net Zero by 2050

Source: Bloomberg NEF July 2023
2. China Leads the World in Renewable Energy

China installed 108GW of Wind and Solar in 1HCY2023, and is on track to deliver their 1,200GW by 2030 RE target 6 years early

<table>
<thead>
<tr>
<th>New Capacity Installed in China in Jan-June 2023</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Thermal Power</td>
</tr>
<tr>
<td>Hydropower</td>
</tr>
<tr>
<td>Nuclear Power</td>
</tr>
<tr>
<td>Wind Power</td>
</tr>
<tr>
<td>Solar Power</td>
</tr>
<tr>
<td>Other (Biomass, W2E)</td>
</tr>
<tr>
<td><strong>Total capacity added</strong></td>
</tr>
</tbody>
</table>

Variable Renewable adds 108
Zero Emissions Capacity Adds 115

Source: NBS, CEF Estimates
2. China Leads the World in EVs

China EV share in June 2023 was 34% of total passenger sales. And Year to date China EV sales +44% yoy.

<table>
<thead>
<tr>
<th>China Automobile Sales</th>
<th>Jun-23</th>
<th>YoY</th>
<th>Market Share</th>
<th>YTD 2023</th>
<th>YoY</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Vehicles</td>
<td>2,268,000</td>
<td>5%</td>
<td>34%</td>
<td>11,268,000</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>EVs</td>
<td>767,000</td>
<td>35%</td>
<td></td>
<td>3,577,000</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>of which BEVs</td>
<td>535,000</td>
<td>19%</td>
<td></td>
<td>2,555,000</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>of which PHEVs</td>
<td>232,000</td>
<td>93%</td>
<td></td>
<td>1,022,000</td>
<td>91%</td>
<td></td>
</tr>
<tr>
<td>Export</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Vehicles</td>
<td>312,000</td>
<td>58%</td>
<td></td>
<td>1,780,000</td>
<td>88%</td>
<td></td>
</tr>
<tr>
<td>of which EVs</td>
<td>75,000</td>
<td>176%</td>
<td></td>
<td>516,000</td>
<td>164%</td>
<td></td>
</tr>
</tbody>
</table>

*Source: China Association of Automobile Manufacturers, Climate Energy Finance calculations*
2. China Leads the World on Mineral Processing

Supply chain security, cheap RE and resource ownership means Australia should be leveraging our new competitive advantages to lead the global energy transition.

Think ‘China +1’
2. China Leads the World in Renewable Energy

Solar manufacturing scaling up at unbelievable speed

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>2022</th>
<th>Announced as of late 2022</th>
<th>Announced as of end-1Q 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>29%</td>
<td>40%</td>
<td>103%</td>
<td>165%</td>
</tr>
<tr>
<td>Batteries</td>
<td>6</td>
<td>11</td>
<td>78</td>
<td>97</td>
</tr>
<tr>
<td>Electrolyzers</td>
<td>4</td>
<td>5</td>
<td>46</td>
<td>57</td>
</tr>
<tr>
<td>Heat pumps</td>
<td>25</td>
<td>30</td>
<td>39</td>
<td>42</td>
</tr>
<tr>
<td>Wind</td>
<td>24</td>
<td>25</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

Think of ~1,000GW pa of solar installs globally by 2030

The IEA APS assumes 290GW pa 2022-2030 (~400GW by 2030);
NZE scenario assumes 462GW pa 2022-2030 (~600GW by 2030)

Massive PV Manufacturing Complex In China

JinkoSolar Plans RMB 56Bn Vertically Integrated Solar PV Production Compound In Shanxi

25 May 25 2023 Taiyang News

- JinkoSolar has entered an investment framework agreement for a large scale manufacturing complex in Shanxi
- It will host monocrystalline silicon pull rod, silicon wafer, high efficiency solar cells and modules with 56 GW annual capacity each
- Phase I and II with 14 GW capacity for each of the products are planned to enter commercial operations in Q1 and Q2 of 2024

Source: Bloomberg, Multiplying Solar and Battery Factories Put Net Zero in Closer Reach, 25 May 2023
3. US Inflation Reduction Act 2022

~US$800bn funding => a resurgence in US manufacturing post the IRA

FACT SHEET: Bidenomics Has Driven $500 Billion in Private Sector Investments Across the Country, Is Growing South Carolina’s Economy From the Middle Out and Bottom Up

President Biden’s economic agenda—Bidenomics—is growing the American economy from the middle out and the bottom up, not the top down. Tomorrow, President Biden will announce that companies have committed over $500 billion in manufacturing and clean energy investments in the United States since the beginning of his Administration. The President will visit South Carolina, where companies have announced $11 billion in manufacturing and clean energy investments, and the Biden-Harris Administration has already awarded $2.6 billion in funding for infrastructure projects. The President will highlight that Enphase Energy is joining a growing list of companies beginning clean energy manufacturing operations in the United States—mobilized directly by President Biden’s Inflation Reduction Act—creating 1,800 new jobs nationwide, including up

3. Korea’s Refocus on the US IRA

Battery Makers Plow $31 Billion Into Remaking Korean Steel Hub

*The city of Pohang built up a world class steel industry over decades. Now it’s turning to EV batteries.*

President Yoon Suk Yeol said ‘the government and companies including Samsung Electronics Co. will pour US$422bn into areas such as chips and EV in the nation’s most aggressive effort yet to win a heated global race for tech supremacy’

The sun sets over the Posco steel mill in Pohang, South Korea, on July 17, 2018. The city is increasingly seen as the country’s new capital for the electric vehicle battery industry.

A South Korean city home to one of the world’s biggest steelmakers is betting its manufacturing expertise, billions of dollars in investments and government incentives can help it dominate a 21st century industry: electric vehicle batteries.

Companies in the south-eastern hub of Pohang — famous for *Posco Holdings Inc.* steel mills and one of the country’s elite universities — are aggressively building out EV battery campuses as automakers hurry to find reliable suppliers outside China. Three South Korean giants in the global battery market — LG Energy Solution Ltd., Samsung SDI Co. and SK On Co. — have promised 40 trillion won ($31 billion) in domestic investments with their local suppliers.

Source: Bloomberg’s Heejin Kim 16 March 2023
4. Australia’s Critical Minerals Strategy

South Korea-Australia Integrated Mining-Batteries-EV Cooperation

29 June 2023

A VALUE-ADDED CRITICAL MINERALS BILATERAL AGREEMENT FOR AUSTRALIA AND SOUTH KOREA

Australia’s imperative to create a mutually-beneficial bilateral agreement with South Korea, leveraging the US Inflation Reduction Act to complement Korea’s battery industry and value-add onshore

Matt Pollard, Global EV Supply Chain Analyst, CEF
Tim Buckley, Director, CEF
Dr Annemarie Jonson, Director Communications

Figure: Global EV Battery Manufacturer Market Share 2022:

Source: SNE Research, CleanTechnica
4. Australia-US Compact

Climate change, critical minerals and clean energy is third pillar of the Australia-US alliance

The US will back Oz for COP31 in partnership with our Pacific neighbours.

Supply chains: Oz treated as a US domestic source; but unlikely direct US subsidies to Oz projects;

The Quad investor network, EFA-US EXIM collaboration

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Australia and the United States commit to enhance bilateral cooperation under a Climate, Critical Minerals and Clean Energy Transformation Compact (the Compact), establishing climate and clean energy as a central pillar of the Australia-United States Alliance. Australia and the United States recognise the importance of addressing the climate crisis as a critical component of the bilateral relationship. The Compact is a framework which is designed to advance ambitious climate and clean energy action this decade, at home and abroad. The framework intends to coordinate policies and investments to support the expansion and diversification of responsible clean energy and critical minerals supply chains, accelerate the development of markets for established and emerging technologies, meet the growing energy and adaptation needs of the Indo-Pacific, and enhance the region’s role as a driver of resilient and sustainable global prosperity.

Source: Whitehouse, 20 May 2023

4. Australia’s Critical Minerals Strategy

Critical Minerals Strategy 2023–2030

Create diverse, resilient and sustainable supply chains through strong and secure international partnerships
We will supply processed critical minerals to diversify global markets and support Australia’s access to priority technologies. This includes working with international partners to build secure, resilient and sustainable supply chains that reduce market concentration. We will enhance our high environmental, social, and governance (ESG) credentials and our status as a trusted and reliable trading partner.

Build sovereign capability in critical minerals processing
We will move up the critical minerals value chain and increase Australia’s footprint in downstream processing. We will make high-value products that build new industries and strengthen our domestic resilience to supply chain shocks.

Use our critical minerals to help become a renewable energy superpower
We will unlock our vast potential as a major supplier of the critical minerals needed to decarbonise the global economy. Australia’s critical minerals sector will help the world decarbonise, including enabling Australia to reach our own legislated targets of 43 per cent below 2005 levels by 2030 and net zero by 2050.

Extract more value onshore from our resources – creating jobs and economic opportunity, including for regional and First Nations communities

This could add $134bn to Oz GDP and create 262,600 new jobs by 2040 =>
“Proportionate” response:

- $500m funding for NAIF (new)
- $225m to Geoscience Australia
- $100m critical minerals development program.
- $2bn EFA critical minerals facility
- NRF: $3bn Low emissions tech
- NRF: $1bn Resources value-add
- $50m Australian Critical Minerals R&D Hub
- $57m Critical Minerals International Partnerships
- Powering the Regions Fund: $1.9bn
- $3.1bn Australian Apprentices Incentive System
- $500m Jobs & Skills Councils
- $105m New Energy Apprenticeships

Another critical minerals review 2026

Another $100bn of public capital to crowd-in $200-300bn of private capital

Source: Resource Minister King, 20 June 2023
4. Exporting Embodied Decarbonisation

Australia needs to move on from the ‘dig-and-ship’ view

Liontown snares Western alliance solution to funding shortfall

*Kalgoorlie | Brad Thompson Aug 7, 2023 – AFR*

**Liontown Resources** has won backing from a coalition of government finance agencies in Australia, South Korea and the US to bridge a $300m funding shortfall for its flagship lithium project in Western Australia.

The breakthrough secures the funds needed to complete the $895m Kathleen Valley project. The finance package could be increased and used for working capital against a background of rising costs in the WA mining sector and *lithium market jitters*.

Liontown also announced on Monday that it had joined forces with Japan’s *Sumitomo Corporation* to study the feasibility of building a lithium sulphate plant in WA that would supply a finishing plant in Japan producing lithium hydroxide.

The funding option, although not finalised, gets Liontown closer to its 2024 production target for Kathleen Valley after it last week unveiled plans to start shipping unprocessed lithium to realise some cash.

*Export Finance Australia*, the *Korea Trade Insurance Corporation (K-Sure)* and the *Export-Import Bank of the United States (EXIM)* have issued individual letters of support, underlining the strategic importance Western nations have placed on reducing their reliance on China for battery materials.

Liontown is continuing talks with customers, commercial banks and other government funding agencies about additional finance.
5. AGL

AGL Energy is an example of impact investing when engagement then divestment both failed.

Source: Yahoo Finance
5. Woodside vs Pilbara Minerals

Fossil Fuel Exposures vs Energy Transition – looking through the commodity cycle (Woodside Energy vs All Ords vs Pilbara Minerals)

Source: Yahoo Finance
5. Nextera vs Exxon

Nextera Energy US vs Exxon vs S&P500: Fossil Fuels vs Electrify Everything

Source: Yahoo Finance
5. Insurance Implications

The Implications of Climate Change are Rapidly Emerging

"There are now 12% of households experiencing home insurance affordability stress"

Almost one year on from the publication of the Actuaries Institute's Green Paper *Home Insurance Affordability and Socioeconomic Equity in a Changing Climate*, home insurance affordability remains an ongoing and significant issue in Australia.

Affordability pressures have risen for almost all Australian households since the 2022 Green Paper, with increases in home insurance premiums (driven by both higher sum insureds and rate increases) not matched by household income growth. In particular, while the median increase in home insurance premiums over the last 12 months was 28%, the impacts were far greater for the highest risk properties, increasing by more than 50% for the 5% of households paying the highest premiums.

There are now 12% of households experiencing home insurance affordability stress (up from 10% in March 2022) where affordability stress is defined as paying more than four weeks of household gross income towards home insurance premiums. Overall, we estimate that 1.24 million Australian households face home insurance affordability stress compared to 1 million a year ago. The average